

## Appendix H.

# RADS Radar Parameters

## Version 1.2

Radar Parameters are defined as all those parameters required to direct the radar transmitter, receiver, antenna pointing and real-time data processing, plus any additional housekeeping parameters required in the UF header, expressed in a form that can most directly control the radar. For example, the pulse repetition period is expressed, rather than the maximum unambiguous velocity or maximum unambiguous range. These parameters form a complete set, with no other parameters being required for radar operation or data recording.

Because there are so many parameters (about 123), they are classified into ten primary types: timing (TM), calibration (CL), transmit (TX), receive (RX), scanning (SC), data processing (DP), housekeeping (HK), GPS (GP), navigation (NV), phase-retarding plate (PL) and spare (SP). In general, timing and calibration take precedence over the other types in situations where a parameter might be considered to be in more than one type. For instance, PRPL is a TM parameter rather than a TX parameter, and receiver gain is a CL parameter rather than an RX parameter. This classification is used only for convenience in displaying groups of parameters, *i.e.*, the classification of a parameter has no functional significance beyond specifying how it is displayed to the operator.

Setting a bit in a 32-bit word associated with that parameter identifies each parameter type. This allows for the identification of additional overlapping types of parameters. For instance, all parameters normally varied when running in pulse-pair mode have a certain bit set so that they can be conveniently displayed when operating in that mode.

There are two bits that control access to the parameters: OE and PA, for Operator Enabled and Password Accessible. OE set indicates that any radar operator running the Radar Control Program (RCP) can change the value of that parameter. PA set indicates that the parameter can be changed, but only by knowledge of a password. Those parameters without either bit set are initialized by a different program, and then read into the RCP, or else they are parameters set by the RCP, such as TIME. Setting both OE and PA is not allowed.

Many of the calibration parameters depend on the receiver bandwidth, and so these parameters are in the form of a vector to accommodate three possible receiver bandwidths. With parameters of this type, which can take on several values, the actual value being used (determined by whatever receiver bandwidth has been selected) is stored in the first element (zeroth element in C nomenclature), and the possible values are stored in the following elements. Thus parameters that can take three possible values are stored in a four-element vector. The radar constant has two possible values depending on whether oceanic or atmospheric targets are being observed, and so is similarly stored in a three-element vector.

Also many calibration parameters have an “h” or “v” in their names, for horizontal and vertical polarization. In radars where this is not appropriate, they stand for co-polarized and cross-polarized, respectively.

\*.rp's are stored in /export/home/rcp/rp with an identifying name. When the RCP is started, it loads the file default.rp or some other programmer-specified file. Other sets of RPs can be loaded by operator command.

Most of the UF header can be derived from the Radar Parameters; the remaining UF header entries have a fixed value, or are dependent on the position of parameters within the UF header itself.

The Radar Parameters are all defined, with the exception of ASCII parameters, in terms of 32-bit numbers in order to be compatible with the DSP which has only 32-bit data types. These parameters reside in the SPARC's slave window where they are accessible to both the DSP, or any other VME master, and any process running on the SPARC. Note that because the DSP uses 32 bits to represent a char, that the structure used for the DSP must be slightly different than the structure used on the SPARC. A declaration like SCNM[8] on the SPARC must be changed to SCNM[2] for the DSP. The following table shows the SPARC structure.

The limits shown on individual parameters in the table are worst case limits that are large enough to encompass all modes of operation. Depending on the particular mode of operation, or the particular radar, other more restrictive limits are placed on certain parameters.

Changes from Version 1.1 are shaded.

Table 1. Revision history.

Version 1.0	1000-byte header released primarily to support USCG activities and Phase-Retarding Plate information.
Version 1.1	Added RLEN parameter to support mode 103.
Version 1.2	Added 12 parameters to support GRIDS.

Table 2. Radar parameters, version 1.2

	Parameter	Description	Data type	Units	Bytes	Type of parameter*	Lower limit	Upper limit	GRAD S use?	Comment
1	RPSV	Radar Parameter structure version number (this structure)	float	none	4	HK	0.0	20.0	yes	Major rev when structure change alters parameter displacements (Version 1.2)
2	NPRM	Number of parameter names, excluding spares	uint	none	4	HK	50	200	yes	123 in this version
3	RTGC	Radar Timing Generator Control	uint	none	4	TM	0	65535	yes	Controls local/slave mode and Run bit
4	CLKF	Basic clock frequency of radar timing generator	float	Hz	4	TM   PA	16e6	20e6	no	16 MHz or 20 MHz
5	NTRG	Number of triggers in beam	uint	none	4	TM   OE	32	1048576	yes	Dependent parameter in FFT modes: NTRG = NCOH x NSMP x NSPC
6	PRPL	Inter- pair repetition period	float	seconds	4	TM   OE	70e-6	16e-3	yes	formerly PRPR
7	PRPS	Intra-pair trigger spacing	float	seconds	4	TM   OE	.05e-3	1.024e-3	no	formerly TRGS
8	NPWT	Number of pairs of triggers to wait between beams	uint	none	4	TM   OE	0	1023	no	
9	DLAY	Delay from trigger to first range gate	float	seconds	4	TM   OE	2e-6	1025e-6	yes	
10	SPAC	Spacing between range gates	float	seconds	4	TM   OE	50e-9	16e-6	yes	
11	NGAT	Number of range gates	uint	none	4	TM   OE	1	16384	yes	formerly NRGT
12	RTLN	Length of radar trigger	float	seconds	4	TM   OE	50e-9	12.8e-6	yes	OE only in GRADS 0 turns off transmitter in GRADS Same as TXWD in GRADS
13	BASP	Spacing from first (B) to second pre-trigger (A)	float	seconds	4	TM   PA	1e-6	63e-6	no	
14	B0SP	Spacing from first pre-trigger (B) to main trigger (0)	float	seconds	4	TM   PA	2e-6	64e-6	no	
15	TPL1[4]	Transmit polarization for first four polarizations in beam	char	none	4	TM   OE	0	0xffffffff	no	H – horizontal V – vertical S – split (both H and V) C – co-polar X – cross-polar
16	TPL2[4]	Transmit polarization for second four polarizations in beam	char	none	4	TM   OE	0	0xffffffff	no	same as above
17	RPL1[4]	Receive polarization for first four polarizations in beam	char	none	4	TM   OE	0	0xffffffff	yes	h – horizontal v – vertical s – split (both h & v using two rcvs) c – co-polar x – cross-polar

	Parameter	Description	Data type	Units	Bytes	Type of parameter*	Lower limit	Upper limit	GRAD S use?	Comment
18	RPL2[4]	Receive polarization for second four polarizations in beam	char	none	4	TM   OE	0	0xffffffff	yes	same as above
19	RPDL	Received polarization delay	float	seconds	4	TM   PA	100e-9	12.8e-6	yes	50 ns resolution
20	NSYC	Number of iSync's per SYNC	uint	none	4	TM	1	4	yes	Values 1, 2 or 4. DMOD dependent.
21	spare		uint		4	SP	0	0		
22	spare		uint		4	SP	0	0		
23	spare		uint		4	SP	0	0		
24	spare		uint		4	SP	0	0		
25	DMOD	Data mode (tmsr, spec, plpr, delk, etc.)	uint	none	4	DP   OE	0	255	yes	
26	ERRC	Error code from DSP	uint	none	4	DP	0	255	yes	returned from DSP on error
27	NDEC	Number of decimation steps (number of frequency cycles in average)	uint	none	4	DP   OE	1	8192	no	delta-k mode only
28	NSMP	Number of samples (meaning varies w/mode)	uint	none	4	DP   OE	1	16384	yes	In FFT modes, represents number of spectral points.
29	SCLF	Scale factor for integer data met units = tape value/SCLF	int	varies	4	DP	0	32767	no	0 signifies floating point
30	BPDS	Bits per data sample	uint	bits	4	DP	8	32	no	32 for floating point
31	OCEN	Non-zero indicates ocean mode.	uint	Boolean	4	DP	0	0xffffffff	no	
32	NCOH	Number of coherent averages	uint	none	4	DP   OE	1	64	yes	FFT modes
33	NSPC	Number of spectrum averaged	uint	none	4	DP   OE	1	65536	yes	FFT modes
34	spare		uint		4	SP	0	0		
35	spare		uint		4	SP	0	0		
36	spare		uint		4	SP	0	0		
37	spare		uint		4	SP	0	0		
38	spare		uint		4	SP	0	0		
39	spare		uint		4	SP	0	0		
40	TPWR	Transmitter peak power	float	watts	4	TX   PA	1.0	200e3	yes	
41	TFLG	Transmitter flag	int	none	4	TX	-1	1	yes	1 -- magnetron -1 -- klystron
42	TFMD	Transmit frequency mode	uint	none	4	TX	0	2	yes	0 -- fixed frequency 1 -- linear stepping 2 -- Goloumb stepping
43	TFRQ	Transmit frequency of radar. In stepping mode, the lowest or first frequency.	float	Hz	4	TX   OE	9e9	35e9	yes	
44	TFST	Transmit frequency step	float	Hz	4	TX   OE	1000	10e6	no	Stepping only

	Parameter	Description	Data type	Units	Bytes	Type of parameter*	Lower limit	Upper limit	GRAD S use?	Comment
45	NTFR	Number of different transmit frequencies	uint	none	4	TX   OE	1	64	no	Stepping only
46	TMDL	TMEN (Transmit Envelope) delay	float	seconds	4	TM TX PA	100e-9	12.8e-6	yes	50 ns resolution.
47	TMWD	TMEN width	float	seconds	4	TM TX PA	50e-9	12.8e-6	yes	50 ns resolution.
48	TXDL	TXPL (Transmit Pulse) delay	float	seconds	4	TM TX PA	100e-9	12.8e-6	yes	50 ns resolution.
49	spare		uint		4	SP	0	0		
50	spare		uint		4	SP	0	0		
51	spare		uint		4	SP	0	0		
52	spare		uint		4	SP	0	0		
53	RPDH	Receiver pad, horizontal	float	dB	4	RX   OE	0.0	50.0	no	
54	RPDV	Receiver pad, vertical	float	dB	4	RX   OE	0.0	50.0	no	
55	TRDL	TREN (Transmit-Receive Envelope) delay	float	seconds	4	TM RX PA	100e-9	12.8e-6	yes	50 ns resolution.
56	TRWD	TREN width	float	seconds	4	TM RX PA	50e-9	12.8e-6	yes	50 ns resolution.
57	BLDL	BLNK (Blank) delay	float	seconds	4	TM RX PA	100e-9	12.8e-6	yes	50 ns resolution.
58	BLWD	BLNK width	float	seconds	4	TM RX PA	50e-9	12.8e-6	yes	50 ns resolution.
59	spare		uint		4	SP	0	0		
60	spare		uint		4	SP	0	0		
61	spare		uint		4	SP	0	0		
62	SWPM	Sweep mode	uint	none	4	SC   OE	0	6	yes	1 -- PPI (constant elevation) 2 -- Coplane (future) 3 -- RHI (constant azimuth) 4 -- Vertical 5 -- Target (stationary) 6 -- Manual 7 -- Idle (out of control) 8 -- Sector (non-UF code, use 1 in UF)
63	MNAZ	Minimum (CCW) azimuth	float	degrees	4	SC   OE	-180.	360.	no	
64	MXAZ	Maximum (CW) azimuth	float	degrees	4	SC   OE	-180.	360.	no	
65	MNEL	Minimum elevation angle	float	degrees	4	SC   OE	-20.	135.	yes	
66	MXEL	Maximum elevation angle	float	degrees	4	SC   OE	-20.	135.	yes	
67	ANGF	Fixed angle	float	degrees	4	SC	-180.	360.	yes	generated by scan process
68	ANGI	Fixed angle increment	float	degrees	4	SC   OE	0.0	90.	yes	
69	BLAZ[3]	Baseline azimuth	float	degrees	12	SC   PA	0.0	360.	no	future: allows for COPLANE scanning with 2 other radars.
70	BLEL[3]	Baseline elevation	float	degrees	12	SC   PA	-20.	20.	no	Same as above.
71	SWTM	Sweep time	float	seconds	4	SC   OE	2.0	1e6	yes	In non-scanning modes, indicates how long files are.

	Parameter	Description	Data type	Units	Bytes	Type of parameter*	Lower limit	Upper limit	GRADS use?	Comment
72	AZIM	Current azimuth angle	float	degrees	4	SC   PA	0.0	360.0	yes	fixed in GRADS. PA in GRADS only.
73	ELEV	Current elevation angle	float	degrees	4	SC   PA	-20.0	180.0	yes	fixed in GRADS. PA in GRADS only.
74	SCNM[8]	Scan name	char	none	8	SC   OE	0	0xffffffff	yes	specified by scan table name in RCP
75	spare		uint		4	SP	0	0		
76	spare		uint		4	SP	0	0		
77	spare		uint		4	SP	0	0		
78	spare		uint		4	SP	0	0		
79	spare		uint		4	SP	0	0		
80	spare		uint		4	SP	0	0		
81	spare		uint		4	SP	0	0		
82	TNUM	Tape number	uint	none	4	HK   OE	0	65535	yes	
83	TIME	UNIX time. Seconds since 01/01/70	uint	seconds	4	HK	820e6	1578e6	yes	Always in GMT
84	TIMS	Time past second in nanoseconds	uint	ns	4	HK	0	1000000000	yes	Standard UNIX structure
85	TMZN[4]	Local time zone	char	none	4	HK   PA	0	0xffffffff	yes	Local time zone. GMT, MST, etc. First 2 characters go into UF header.
86	TMOF	Time zone offset from GMT	int	hours	4	HK   PA	-12	12	yes	For MST, TMOF = -7
87	LAT	Latitude of radar, degrees	float	degrees	4	HK	-90.0	90.0	yes	
88	LONG	Longitude of radar, degrees	float	degrees	4	HK	-180.0	180.0	yes	West long is negative
89	ELSL	Elevation above sea level of radar	float	meters	4	HK	-300.0	8840.0	yes	
90	OPNM[8]	Operator name	char	ASCII	8	HK   OE	0	0xffffffff	yes	
91	RDNM[8]	Radar name	char	ASCII	8	HK   PA	0	0xffffffff	yes	
92	STNM[8]	Site name	char	ASCII	8	HK   PA	0	0xffffffff	yes	
93	PRNM[8]	Project name	char	ASCII	8	HK   PA	0	0xffffffff	yes	
94	FTNM[8]	Field tape name	char	ASCII	8	HK   OE	0	0xffffffff	yes	
95	BMNM	Beam number within sweep	uint	none	4	HK	0	65535	yes	
96	SWNM	Sweep number within volume	uint	none	4	HK	0	65535	no	
97	VLMN	Volume number within tape	uint	none	4	HK	0	65535	no	
98	RCPN	RCP version number	float	none	4	HK   PA	0	20.0	yes	
99	RCDE	Indicates data is to be recorded	uint	Boolean	4	HK   OE	0	1	yes	
100	TDRV	Tape drive SCSI address	uint	none	4	HK	0	7	no	Useful in debugging drive problems
101	RLEN	Record size (RP header + data)	uint	bytes	4	HK	0	0xffffffff	yes	Added in 1.1 to support mode 103
102	RDID	Radar ID number	uint	none	4	HK PA	0	0xffffffff	yes	
103	spare		uint		4	SP	0	0		
104	spare		uint		4	SP	0	0		
105	spare		uint		4	SP	0	0		

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	Parameter	Description	Data type	Units	Bytes	Type of parameter*	Lower limit	Upper limit	GRAD S use?	Comment
106	spare		uint		4	SP	0	0		
107	spare		uint		4	SP	0	0		
108	txph	Horizontal transmit power	float	watts	4	CL   PA	0	1e6	yes	h & v may also represent co-polar & cross-polar in all parameters they appear in
109	txpv	Vertical transmit power	float	watts	4	CL   PA	0	1e6	yes	
110	rnbw[4]	Possible receiver linear bandwidths	float	Hz	16	CL	100e3	40e6	yes	
111	rgbw[4]	Possible receiver log bandwidths	float	Hz	16	CL	100e3	40e6	no	
112	rmh[4]	gain of the linear horizontal receiver by BW	float	dB	16	CL   PA	0.0	120.0	yes	
113	rnv[4]	gain of the linear vertical receiver by BW	float	dB	16	CL   PA	20.0	120.0	yes	
114	rg1h[4]	RF gain of the log horizontal receiver by BW	float	dB	16	CL   PA	100.0	150.0	no	
115	rg2h[4]	IF gain of the log horizontal receiver by BW	float	dB	16	CL   PA	-30.0	10.0	no	
116	rg1v[4]	RF gain of the log vertical receiver by BW	float	dB	16	CL   PA	100.0	150.0	no	
117	rg2v[4]	IF gain of the log vertical receiver by BW	float	dB	16	CL   PA	-30.0	10.0	no	
118	R0h[4]	Noise value of R from the linear horizontal receiver by BW	float	none	16	CL   PA	0.0	4e-3	yes	
119	R0v[4]	Noise value of R from the linear vertical receiver by BW	float	none	16	CL   PA	0.0	4e-3	yes	
120	khRC[3]	horizontal radar constant by target	float	dB	12	CL   PA	-20.0	120.0	yes	khRC[1] for atmosphere khRC[2] for ocean
121	kvRC[3]	vertical radar constant by target	float	dB	12	CL   PA	-20.0	120.0	yes	kvRC[1] for atmosphere kvRC[2] for ocean
122	pknl[4]	pre-knock from linear in local mode actual dlay = DLAY + pknn by BW	float	seconds	16	CL   PA	-5e-6	0.0	yes	
123	pkgl[4]	pre-knock from log channels in local by BW	float	seconds	16	CL   PA	-5e-6	0.0	no	
124	pksa	pre-knock adjustment for slave mode actual pre-knock = pkxl + pksa	float	seconds	4	CL   PA	0.0	3e-6	no	
125	azbw	Azimuthal beamwidth	float	degrees	4	CL   PA	0.1	5.0	yes	
126	elbw	Elevation beamwidth	float	degrees	4	CL   PA	0.1	30.0	yes	
127	antg[2]	Antenna gain	float	dB	8	CL   PA	20.0	60.0	yes	antg[0] for horizontal pol antg[1] for vertical pol

	Parameter	Description	Data type	Units	Bytes	Type of parameter*	Lower limit	Upper limit	GRAD S use?	Comment
128	aplr	Measure of antenna polarization ratio for elliptically polarized antennas.	float	none	4	CL   PA	0.1	10.0	yes	For elliptically polarized antennas only. H/V
129	ktar[2]	Magnitude of complex refractive index for target	float	none	8	CL   PA	0.25	1.0	yes	Used in radar equation. [0] = horizontal, [1] = vertical value
130	phi0	Differential phase offset	float	radians	4	CL   PA	-6.3	6.3	no	
131	sgnl	Signal generator level	float	dBm	4	CL   PA	-500.0	10.0	no	Used while calibrating
132	spare		uint		4	SP	0	0		
133	spare		uint		4	SP	0	0		
134	spare		uint		4	SP	0	0		
135	spare		uint		4	SP	0	0		
136	spare		uint		4	SP	0	0		
137	spare		uint		4	SP	0	0		
138	spare		uint		4	SP	0	0		
139	GPOS[3]	latitude, longitude, altitude	float	deg, m	12	GP	-1000	5000	yes	If GPS receiver present, this value copied into LAT, LONG, ESL
140	TFIX	GPS time of fix	float	seconds	4	GP	0	604800	yes	Time within GPS week. Added 5/98
141	GPFX[2]	time of GPOS fix in UNIX seconds & nanoseconds	uint	secs, nsec	8	GP	0	$2^{31} - 1$	yes	
142	GVEL[3]	3-axis velocity (East-North-Up)	float	m/s	12	GP	-1000	+1000	no	
143	GVFX[2]	time of GVEL fix in UNIX seconds & nanoseconds	uint	secs, nsec	8	GP	0	$2^{31} - 1$	no	
144	spare		uint		4	SP	0	0		
145	spare		uint		4	SP	0	0		
146	spare		uint		4	SP	0	0		
147	spare		uint		4	SP	0	0		
148	spare		uint		4	SP	0	0		
149	spare		uint		4	SP	0	0		
150	HEAD	heading from true north	float	degrees	4	NV	-360.0	360.0	no	ARINC 582 or 571 (specify later)
151	TRCK[2]	speed, bearing over ground	float	m/s, deg	8	NV	-360.0	360.0	no	ARINC 582 or 571 (specify later)
152	NPOS[3]	latitude, longitude, altitude	float	deg, m	12	NV	-1000	5000	no	(582, 582, NA)
153	NATD[3]	pitch, roll, yaw	float	degrees	12	NV	-360.0	360.0	no	synchro?
154	NVEL[3]	N velocity, E velocity, Up velocity	float	m/s	12	NV	-1000	1000	no	(582, ??, 582). Up is integrated vertical acceleration
155	NWND[2]	wind speed, wind angle	float	m/s, deg	8	NV	-360	360	no	(582, 582)
156	NTFX[4]	time of acquisition of ARINC 582 & 571 data in Unix secs and ns	uint	secs, ns	16	NV	0	$2^{31} - 1$	no	(582, 571)
157	spare		uint		4	SP	0	0		

	Parameter	Description	Data type	Units	Bytes	Type of parameter*	Lower limit	Upper limit	GRAD S use?	Comment
158	spare		uint		4	SP	0	0		
159	spare		uint		4	SP	0	0		
160	spare		uint		4	SP	0	0		
161	spare		uint		4	SP	0	0		
162	spare		uint		4	SP	0	0		
163	spare		uint		4	SP	0	0		
164	spare		uint		4	SP	0	0		
165	PLTR	maximum plate retarding phase	float	degrees	4	PL   OE	0	360.0	no	currently 79.5 or 178.7 degrees
166	PLTA	plate orientation angle, actual	float	degrees	4	PL   PA	0	360.0	no	
167	PLTN	minimum plate angle	float	degrees	4	PL   OE	0	360.0	no	for plate scanning
168	PLTX	maximum plate angle	float	degrees	4	PL   OE	0	360.0	no	for plate scanning
169	PLTS	plate step angle	float	degrees	4	PL   OE	0	360.0	no	synchronized to antenna sweeps
170	PLTV	plate angular velocity	float	deg/sec	4	PL   OE	0	1000	no	
171	PLTM	plate mode	uint	none	4	PL   OE	0	10	no	0 – plate fixed 1 – plate rotating continuously 2 – plate stepped 3 – plate oscillating
172	PLTI[4]	plate identification	char	none	4	PL   OE	0	0xffffffff	no	for example, "HWP3"
173	PLTB	plate binary	uint	none	4	PL	0	0xffffffff	no	bits from plate controller
174	spare		uint		4	SP	0	0		
175	spare		uint		4	SP	0	0		
176	spare		uint		4	SP	0	0		
177	spare		uint		4	SP	0	0		
178	spare		uint		4	SP	0	0		
179	spare		uint		4	SP	0	0		
180	spare		uint		4	SP	0	0		
181	spare		uint		4	SP	0	0		
					1000					

\*Types of parameters: TM - timing; CL - calibration; DP - data processing; TX - transmitter; RX - receiver; SC - scanning; HK - housekeeping; GP - GPS (Global Positioning System); NV – navigation (INS) system; PL – plate (phase-retarding plate); SP - spare; OE - operator enabled; PA – password accessible.